Lloyd's Register

Rules and Regulations for the Classification of Ships, July 2009

Notice No. 4

Effective Date of Latest Amendments:

See page 1

Issue date: November 2009

RULES AND REGULATIONS FOR THE CLASSIFICATION OF SHIPS, *July 2009*

Notice No. 4

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Classification of Ships, July 2009.* The amendments are effective on the dates shown:

Part	***Chapter***	***Section***	***Effective date***
1	3	8	1 January 2010
5	1	3	1 January 2010
5	2	6, 9, 18	1 January 2010
5	12	5, 11	1 January 2010
5	13	9	1 January 2010
6	1	3	1 January 2010
7	11	1, 2, 3, 4	1 January 2010
8	1	2	1 January 2010
8	2	2, 3, 6, 7, 9, 10, 11	1 January 2010

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Classification of Ships, July 2009* are to be read in conjunction with this Notice No. 4. The status of the Rules is now:

Rules for Ships	Effective date:	July 2009
Notice No. 1	Effective dates:	1 January 2010 & Corrigenda
Notice No. 2	Effective dates:	1 January 2010 & Corrigenda
Notice No. 3	Effective dates:	1 January 2010 & Corrigendum
Notice No. 4	Effective dates:	1 January 2010 & Corrigenda

Part 1, Chapter 3
Periodical Survey Regulations

Effective date 1 January 2010

■ *Section 8*
Special Survey – Chemical tankers – Hull requirements

8.3 Planning for survey

8.3.1 A Survey Programme is to be submitted by the Owner and is to include the proposals for survey, including the means of providing access for Close-up Survey, thickness measurement~~, and~~ tank testing and should take account of the information detailed in 8.2.1.

8.6 Close-up Survey

8.6.1 The minimum requirements for Close-up Survey are given in Table 3.8.2 (Single hull chemical tankers) and Table 3.8.3 (Double hull chemical tankers).

8.7 Thickness measurement

8.7.1 The minimum requirements for thickness measurements are given in Table ~~3.8.3~~ 3.8.4, *see also* 5.6.

8.7.2 In areas where substantial corrosion, as defined in 1.5, has been noted, then additional measurements are to be carried out, as applicable, in accordance with ~~Tables 3.8.4, 3.8.5, 3.8.6 and 3.8.7~~ Tables 3.8.5, 3.8.6, 3.8.7 and 3.8.8 to determine the full extent of the corrosion pattern. The survey will not be considered complete until these additional thickness measurements have been carried out.

8.8 Ships over 10 years old

8.8.1 Selected steel cargo pipes outside cargo tanks and ballast pipes passing through cargo tanks are to be:

(a) Thickness measured at random or selected pipe lengths to be opened for internal inspection.

(b) Pressure tested to the maximum working pressure.

NOTE:

Special attention is to be given to cargo/slop discharge piping through ballast tanks and void spaces.

Table 3.8.1 Tank testing requirements – Chemical ~~ships~~ tankers

~~**Table 3.8.2 Close-up Survey – Chemical tankers**~~

Special Survey I (Ships 5 years old)	Special Survey II (Ships 10 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
(1) One web frame ring – in a wing ballast tank, if any, or a ballast double hull side tank, *see* Notes 1 and 8 (2) One deck transverse – in a cargo tank or on deck, *see* Note 2 (3) One transverse bulkhead, *see* Note 4: (a) in a ballast tank (b) in a cargo wing tank (c) in a cargo centre tank	(1) All plating and internal structure in a wing ballast tank, if any, or a ballast double hull side tank, *see* Notes 7 and 8 (2) One deck transverse, *see* Note 2: (a) in each of the remaining ballast tanks, or on deck (b) in a cargo wing tank or on deck (c) in 2 cargo centre tanks or on deck (3) Both transverse bulkheads – in a wing ballast tank, if any, or a double hull side tank, *see* Note 3 (4) One transverse bulkhead, *see* Note 4: (a) in each remaining ballast tank (b) in a cargo wing tank (c) in 2 cargo centre tanks	(1) All plating and internal structure, *see* Note 7: (a) in all ballast tanks (b) in a cargo wing tank (2) One web frame ring – in each remaining cargo tank, *see* Note 1 (3) All transverse bulkheads – in all cargo tanks, *see* Note 3 (4) As considered necessary by the Surveyor, *see* Note 5	(1) As Special Survey III (2) Additional transverse areas if deemed necessary by the Surveyor

NOTES

1. Complete transverse web frame ring including adjacent structural members.
2. Deck transverse including adjacent deck structural members.
3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.
4. Transverse bulkhead lower part including girder system and adjacent structural members.
5. Additional complete transverse web frame ring.
6. Ballast tank includes peak tanks.
7. Complete tank – including all tank boundaries and internal structure, and external structure on deck in way of the tank where applicable.
8. Double hull side tank includes double bottom and side tank even though these tanks may be separated.

Table 3.8.2 Close-up Survey – Single hull chemical tankers

Special Survey I (Ships 5 years old)	Special Survey II (Ships 10 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
(1) One web frame ring in a ballast wing tank, *see* Note 1 (2) One deck transverse in a cargo tank or on deck, *see* Note 2 (3) One transverse bulkhead in a ballast tank, *see* Note 3 (4) One transverse bulkhead in a cargo wing tank, *see* Note 3 (5) One transverse bulkhead in a cargo centre tank, *see* Notes 3 and 5	(1) All web frame rings in a ballast wing tank, *see* Note 1 (2) One deck transverse in each remaining ballast tank or on deck, *see* Note 2 (3) One deck transverse in a cargo wing tank or on deck, *see* Note 2 (4) One deck transverse in two cargo centre tanks or on deck, *see* Note 2 (5) Both transverse bulkheads in a ballast wing tank, *see* Note 4 (6) One transverse bulkhead in remaining ballast tank, *see* Note 3 (7) One transverse bulkhead in a cargo wing tank, *see* Note 3 (8) One transverse bulkhead in two cargo centre tanks, *see* Notes 3 and 5	(1) All web frame rings in all ballast tanks, *see* Note 1 (2) All web frame rings in a cargo wing tank, *see* Note 1 (3) One web frame ring in each remaining cargo tank, *see* Note 1 (4) All transverse bulkheads – in all cargo and ballast tanks, *see* Notes 4	(1) As Special Survey III (2) Additional transverse areas if deemed necessary by the Surveyor

NOTES
1. Complete transverse web frame ring including adjacent structural members.
2. Deck transverse including adjacent deck structural members (or external structure on deck in way of the tank).
3. Transverse bulkhead lower part including girder system and adjacent structural members.
4. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.
5. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey.
6. Ballast tank includes peak tanks.

Table 3.8.3 Close-up Survey – Double hull chemical tankers

Special Survey I (Ships 5 years old)	Special Survey II (Ships 10 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
(1) One web frame ring in a ballast double hull tank, *see* Notes 1 and 6 (2) One deck transverse in a cargo tank or on deck, *see* Note 2 (3) One transverse bulkhead in a ballast tank, *see* Note 4 (4) One transverse bulkhead in a cargo wing tank, *see* Note 3 (5) One transverse bulkhead in a cargo centre tank, *see* Notes 3 and 5	(1) All web frame rings in a ballast double hull tank, *see* Notes 1 and 6 (2) The knuckle area and the upper part (approx. 3 m) of one web frame ring in each remaining ballast tank (3) One deck transverse in two cargo tanks, *see* Note 2 (4) One transverse bulkhead in each ballast tank, *see* Note 4 (5) One transverse bulkhead in a cargo wing tank, *see* Note 3 (6) One transverse bulkhead in two cargo centre tanks, *see* Notes 3 and 5	(1) All web frame rings in all ballast tanks, *see* Note 1 (2) All web frame rings in a cargo wing tank, *see* Note 1 (3) One web frame ring in each remaining cargo tank, *see* Note 1 (4) All transverse bulkheads – in all cargo and ballast tanks, *see* Note 4	(1) As Special Survey III (2) Additional transverse areas if deemed necessary by the Surveyor

NOTES
1. Complete transverse web frame ring including adjacent structural members.
2. Deck transverse including adjacent deck structural members (or external structure on deck in way of the tank).
3. Transverse bulkhead lower part including girder system and adjacent structural members.
4. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.
5. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey.
6. Double hull tank includes double bottom and side tank even though these tanks may be separate.
7. Ballast tank includes peak tanks.

~~**Table 3.8.3 Thickness measurement – Chemical tankers**~~

Table 3.8.4 Thickness measurement – Single and double hull chemical tankers (*Part only shown*)

Special Survey I (Ships 5 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
(1) 1 section of deck plating for the full beam of the ship within 0,5*L* amidships (in way of a ballast tank, if any) (2) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Table 3.8.2 or 3.8.3 (3) Critical areas, as required by the Surveyor	(1) Within the cargo area: (a) Each deck plate (b) 2 transverse sections (2) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Table 3.8.2 or 3.8.3 (3) Selected wind and water strakes outside the cargo area (4) All wind and water strakes within the cargo area (5) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank, *see* Notes 1 and 4 (6) Critical areas, as required by the Surveyor	(1) Within the cargo area: (a) Each deck plate (b) 3 transverse sections (c) Each bottom plate (2) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Table 3.8.2 or 3.8.3 (3) All wind and water strakes over the full length of the ship, port and starboard (4) Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck) (5) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank and aft peak tank, *see* Notes 1 and 4 (6) All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks (7) Plating of seachests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor (8) Critical areas, as required by the Surveyor
Special Survey II (Ships 10 years old)		
(1) Within the cargo area: (a) Each deck plate (b) 1 transverse section (2) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Table 3.8.2 or 3.8.3 (3) Selected wind and water strakes outside the cargo area (4) Critical areas, as required by the Surveyor		

~~**Table 3.8.4 Thickness measurement – Chemical tankers – Bottom structure with substantial corrosion**~~

Structural member	Extent of measurement	Pattern of measurement
(1) Bottom plating and inner bottom plating	Minimum of 3 bays across tank, including aft bay Measurement around and under all suction strums	5 point pattern for each panel between longitudinals over 1 m length
(2) Bottom longitudinals and inner bottom longitudinals	Minimum of 3 longitudinals in each bay where plating measured	3 measurements in line across flange and 3 measurements on vertical web
(3) Bottom longitudinal girder, transverse floors and web frames	Suspect plates	5 point pattern over about 1 m^2 area
(4) Watertight floors	(a) Lower 1/3 of tank (b) Upper 2/3 of tank	5 point pattern over about 1 m^2 area
(5) Panel stiffening	Where applicable	Single measurements

~~**Table 3.8.5 Thickness measurement – Chemical tankers – Deck structure with substantial corrosion**~~

Structural member	Extent of measurement	Pattern of measurement
(1) Deck plating	2 bands across tank	Minimum of 3 measurements per plate per band
(2) Deck longitudinals	Minimum of 3 longitudinals in each 2 bays	3 measurements in line vertically on webs and 2 measurements on flange (if fitted)
(3) Deck girders and brackets	At fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across face flat. 5 point pattern on girder/bulkhead brackets
(4) Deck transverse webs	Minimum of 2 webs with measurement at both ends and middle of span	5 point pattern over 2 m^2 area. Single measurements on face flat
(5) Panel stiffening	Where applicable	Single measurements

Table 3.8.5 Thickness measurement – Single and double hull chemical tankers – Bottom, inner bottom and hopper structure with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
(1) Bottom, inner bottom and hopper plating	Minimum of 3 bays across double bottom tank, including aft bay. Measurement around and under all suction strums	5 point pattern for each panel between longitudinals and floors
(2) Bottom, inner bottom and hopper longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on vertical web
(3) Bottom girders, including watertight girders	At the fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across face flat (if fitted)
(4) Bottom floors, including watertight floors	3 floors in bays where bottom plating measured, with measurements at both ends and middle	5 point pattern over 2 m^2 area
(5) Hopper web frame ring	3 floors in bays where bottom plating measured	5 point pattern over 1 m^2 of plating. Single measurements on flange
(6) Hopper transverse watertight bulkhead or swash bulkhead	(i) Lower $^1/_3$ of bulkhead	(i) 5 point pattern over 1 m^2 of plating
	(ii) Upper $^2/_3$ of bulkhead	(ii) 5 point pattern over 2 m^2 of plating
	(iii) Stiffeners (minimum of 3)	(iii) For web, 5 point pattern over span (2 measurements across web at each end and 1 at centre of span). For flange, single measurement at each end and centre of span
(7) Panel stiffening	Where applicable	Single measurements

~~**Table 3.8.6 Thickness measurement – Chemical tankers – Shell and longitudinal bulkheads with substantial corrosion**~~

Structural member	Extent of measurement	Pattern of measurement
(1) Deckhead and bottom strakes and strakes in way of stringer platforms	Plating between each pair of longitudinals in a minimum of 3 bays	Single measurement
(2) All other strakes	Plating between every 3rd pair of longitudinals in same 3 bays	Single measurement
(3) Longitudinals – deckhead and bottom strakes	Each longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
(4) Longitudinals – all others	Every third longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
(5) Longitudinals – bracket	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket
(6) Web frames and cross ties	3 webs with minimum of 3 locations on each web, including in way of cross tie connections	5 point pattern over 2 m^2 area, plus single measurements on web frame and cross tie face flats

Table 3.8.6 Thickness measurement – Single and double hull chemical tankers – Deck structure with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
(1) Deck plating	2 transverse bands across tank	Minimum of 3 measurements per plate per band
(2) Deck longitudinals	Every 3rd longitudinal in each of 2 bands with a minimum of 1 longitudinal	3 measurements in line vertically on webs and 2 measurements on flange (if fitted)
(3) Deck girders and brackets	At the fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across flange. 5 point pattern on girder/bulkhead brackets
(4) Deck transverse webs	Minimum of 2 webs, with measurements at both ends and middle of span	5 point pattern over 1 m^2 area. Single measurements on the flange
(5) Vertical web and transverse bulkhead in wing ballast tank (2 m from deck) – for double hull chemical tankers	Minimum of 2 webs, and both transverse bulkheads	5 point pattern over 1 m^2 area
(6) Panel stiffening	Where applicable	Single measurements

~~Table 3.8.7 Thickness measurement – Chemical tankers – Transverse bulkheads and swash bulkheads with substantial corrosion~~

Structural member	Extent of measurement	Pattern of measurement
(1) Deckhead and bottom strakes in way of stringer platforms	Plating between pair of stiffeners at 3 locations: approx. $^1/_4$, $^1/_2$ and $^3/_4$ width of tank	5 point pattern between stiffeners over 1 m length
(2) All other strakes	Plating between pair of stiffeners at middle location	Single measurement
(3) Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange or fabricated connection	5 point pattern over 1 m^2 of plating
(4) Stiffeners	Minimum of 3 typical stiffeners	For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection and one at centre of span). For flange, single measurements at each bracket toe and at centre of span
(5) Brackets	Minimum of 3 at top, middle and bottom of tank	5 point pattern over area of bracket
(6) Deep webs and girders	Measurements at toe of bracket and at centre of span	For web, 5 point pattern over 1 m^2 area. 3 measurements across face flat
(7) Stringer platforms	All stringers with measurements at middle and both ends	5 point pattern over 1 m^2 area, plus single measurements near bracket toes and on face flats

Table 3.8.7 Thickness measurement – Single and double hull chemical tankers – Side shell and longitudinal bulkheads with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
(1) Side shell and longitudinal bulkhead plating:		
(i) Top and bottom strakes, and strakes in way of horizontal girders	(i) Plating between each pair of longitudinals in a minimum of 3 bays (along the tank)	(i) Single measurements
(ii) All other strakes	(ii) Plating between every 3rd pair of longitudinals on same 3 bays	(ii) Single measurements
(2) Side shell and longitudinal bulkhead longitudinals on:		
(i) Top and bottom strakes	(i) Each longitudinal in same 3 bays	(i) 3 measurements across web and 1 measurement on flange
(ii) All other strakes	(ii) Every 3rd longitudinal in same 3 bays	(ii) 3 measurements across web and 1 measurement on flange
(3) Longitudinals – brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket
(4) Vertical web and transverse bulkheads of double side tanks (excluding deckhead area):		
(i) Strakes in way of horizontal girders	(i) Minimum of 2 webs and both transverse bulkheads	(i) 5 point pattern over approximately 2 m^2 area
(ii) Other strakes	(ii) Minimum of 2 webs and both transverse bulkheads	(ii) 2 measurements between each pair of vertical stiffeners
(5) Web frames and cross ties for other tanks than double side tanks	3 webs with minimum of 3 locations on each web, including in way of cross tie connections and lower end bracket	5 point pattern over approximately 2 m^2 area of webs, plus single measurements on flanges of web frame and cross ties
(6) Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
(7) Panel stiffening	Where applicable	Single measurements

Table 3.8.8 Thickness measurement – Single and double hull chemical tankers – Transverse watertight bulkheads and swash bulkheads with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
(1) Upper and lower stool, where fitted	Transverse band within 25 mm of welded connection to inner bottom/deck plating Transverse band within 25 mm of welded connection to shelf plate	5 point pattern between stiffeners over 1 m length
(2) Top and bottom strakes, and strakes in way of horizontal stringers	Plating between pair of stiffeners at 3 locations; approximately $^1/_4$, $^1/_2$ and $^3/_4$ width of tank	5 point pattern between stiffeners over 1 m length
(3) All other strakes	Plating between pair of stiffeners at middle location	Single measurement
(4) Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange of fabricated connection	5 point pattern over approximately 1 m^2 of plating
(5) Stiffeners	Minimum of 3 typical stiffeners	For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection and 1 at centre of span). For flange, single measurement at bracket toe and at centre of span
(6) Brackets	Minimum of 3 at top, middle and bottom of tank	5 point pattern over area of bracket
(7) Horizontal stringers	All stringers with measurements at both ends and middle	5 point pattern over 1 m^2 area, plus single measurements near bracket toes and on flanges
(8) Deep webs and girders	Measurements at toe of bracket and centre of span	For webs, 5 point pattern over 1 m^2 area. 3 measurements across face flat

Part 5, Chapter 1
General Requirements for the Design and Construction of Machinery

Effective date 1 January 2010

■ *Section 3*
Control and supervision of unattended machinery

3.8 Power conditions for generator sets

3.8.1 Auxiliary engines coupled to electrical generators are to be capable under service conditions of developing continuously the power to drive the generators at full rated output (kW) and in the case of oil engines and gas turbines, of developing for a short period (15 minutes) an overload power of not less than 10 per cent, *see* Pt 6, Ch 2,8.2. In the case of oil engines, they are to be tested at works trials at an overload power of 10 per cent for a period of 30 minutes, *see* Table 2.18.1 in Pt 5, Ch 2.

Part 5, Chapter 2
Oil Engines

Effective date 1 January 2010

■ *Section 6*
Crankcase safety fitting

~~6.5~~ ~~Alarms~~

~~*6.5.1* Alarms giving warning of the overheating of engine running parts, indicators of excessive wear of thrusts and other parts, and crankcase oil mist detectors are recommended as means for reducing the explosion hazard. These devices should be arranged to give an indication of failure of the equipment or of the instrument being switched off when the engine is running.~~

Exitising sub-Sections 6.6 *to* 6.9 *are to be renumbered* 6.5 *to* 6.8.

~~6.9~~ 6.8 Oil mist detection~~/monitoring~~

~~*6.9.1*~~ *6.8.1* Where crankcase oil mist detection ~~/monitoring~~ arrangements are fitted, they are to be of a type approved by LR, tested in accordance with Section 14 and comply with ~~6.9.2 to 6.9.15~~ 6.8.2 to 6.8.15.

~~*6.9.2*~~ *6.8.2* The oil mist detection~~/monitoring~~ system and arrangements are to be installed in accordance with the engine designer's and oil mist detection equipment manufacturer's instructions/recommendations. The following particulars are to be included in the instructions:

(a) Schematic layout of engine oil mist detection~~/monitoring~~ and alarm system showing locations of engine crankcase sample points and cabling/piping arrangements together with pipe dimensions to detector~~/monitor~~.
(b) Evidence of study to justify the selected locations of sample points and sample extraction rate (if applicable) in consideration of the crankcase arrangements and geometry and the predicted crankcase atmosphere where oil mist can accumulate.
(c) The manufacturer's maintenance and test manual.
(d) Information relating to type or in-service testing of the engine with engine protection system test arrangements having approved types of oil mist ~~monitoring~~ detection equipment.

~~*6.9.3*~~ *6.8.3* A copy of the oil mist detection~~/monitoring~~ equipment maintenance and test manual required by ~~6.9.2~~ 6.8.2 is to be provided on board ship.

~~*6.9.4*~~ *6.8.4* Oil mist ~~monitoring~~ detection and alarm information is to be capable of being read from a safe location away from the engine.

~~*6.9.5*~~ *6.8.5* In the case of multi engine installations, each engine is to be provided with individual, dedicated oil mist detection~~/monitoring~~ arrangements and ~~a dedicated~~ alarm(s).

~~*6.9.6*~~ *6.8.6* Oil mist detection~~/monitoring~~ and alarm systems are to be capable of being tested on the test bed and on board when the engine is at a standstill and when the engine is running at normal operating conditions in accordance with test procedures that are acceptable to LR.

~~*6.9.7*~~ *6.8.7* Alarms and ~~shutdowns~~ safeguards for the oil mist detection~~/monitoring~~ system are to be in accordance with Pt 6, Ch 1 as applicable.

~~6.9.8~~ 6.8.8 The oil mist detection~~/monitoring~~ arrangements are to provide an alarm indication in the event of a foreseeable functional failure in the equipment and installation arrangements. *See* Pt 6, Ch 1,2.4.6.

~~6.9.9~~ 6.8.9 The oil mist detection~~/monitoring~~ system is to provide an indication that any lenses fitted in the equipment and used in determination of the oil mist level have been partially obscured to a degree that will affect the reliability of the information and alarm indication.

~~6.9.10~~ 6.8.10 Where oil mist detection~~/monitoring~~ equipment includes the use of programmable electronic systems, the arrangements are to be in accordance with Pt 6, Ch 1 as applicable.

~~6.9.11~~ 6.8.11 Schematic layouts showing details and arrangements of oil mist detection~~/monitoring~~ and alarm systems are to be submitted. *See* Pt 5, Ch 1,1.

~~6.9.12~~ 6.8.12 The equipment together with detectors~~/monitors~~ is to be tested when installed on the test bed and on board ship to demonstrate that the detection~~/monitoring~~ and alarm system functions correctly. The testing arrangements are to be to the satisfaction of the Surveyor.

~~6.9.13~~ 6.8.13 Where sequential oil mist detection~~/monitoring~~ arrangements are provided, the sampling frequency and time is to be as short as reasonably practicable.

■ *Section 9*
Component tests and engine type testing

9.1 Hydraulic test

Table 2.9.1 Test pressures for oil engine components

Item	Test pressure
Fuel injection system { Pump body, pressure side; Valve; Pipe }	The lesser of 1,5*p* or *p* + ~~295~~ 300 bar
Cylinder cover, cooling space Cylinder liner, over the whole length of cooling space Piston crown, cooling space (where piston rod seals cooling space, test after assembly)	7,0 bar
Cylinder jacket, cooling space Exhaust valve, cooling space Turbo-charger, cooling space Exhaust pipe, cooling space Coolers, each side Engine driven pumps (oil, water, fuel, bilge)	The greater of 4,0 bar or 1,5*p*
Air compressor, including cylinders, covers, intercoolers and aftercoolers	Air side: 1,5*p* Water side: The greater of 4,0 bar or 1,5*p*
Scavenge pump cylinder	4,0 bar
Hydraulic systems (piping, pumps, actuators)	1,5*p*

NOTES
1. *p* is the maximum working pressure in the item concerned.
2. Pumps used in jerk or timed pump systems need only have the assembled high pressure-containing components hydraulically tested.
3. Turbo-charger air coolers need only be tested on the water side.
4. For forged steel cylinder covers and piston crowns alternative testing methods ~~will~~ may be specially considered.
5. For hydraulic systems where design features are such that modifications to the test requirements are necessary, alternative proposals for hydraulic tests are to be submitted for special consideration.

■ *Section 18*
Program for trials of diesel engines to assess operational capability

18.1 Works trials (acceptance test)

Table 2.18.1 Scope of works trials for diesel engines (*Part only shown*)

Engines driving generators		
Trial condition	Duration	Note
100% power (rated power) at rated engine speed, *R*	≥ 50 minutes	After having reached steady conditions (2)
110% power	~~15~~ 30 minutes	After having reached steady conditions (2)(3)

Part 5, Chapter 12
Piping Design Requirements

Effective date 1 January 2010

■ *Section 5*
Plastics pipes

5.6 Manufacture and quality control

5.6.1 All materials for plastics pipes and fittings are to be approved by LR, and are in general to be tested in accordance with Ch 14,4 of the Rules for Materials. For pipes and fittings not employing hand lay up techniques, the hydrostatic pressure test required by Ch 14,4.9 of the Rules for Materials may be replaced by testing carried out in accordance with the requirements stipulated in a National or International Standard, consistent with the intended use for which the pipe or fittings are manufactured, provided there is an effective quality system in place complying with the requirements of Ch 14,4.4 of the Rules for Materials and the testing is completed to the satisfaction of the LR Surveyor.

■ *Section 11*
Austenitic stainless steels

11.1 Pipe thickness

11.1.1 The minimum thickness of austenitic stainless steel pipes is to be determined from the formula given in 2.2.1 and either 2.2.3 or 2.2.4 using a corrosion allowance of 0,8 mm. Values of 0,2 per cent proof stress and tensile strength of the material for use in the formula in 2.2.1 may be obtained from Table 6.5.2 in Chapter 6 of the Rules for Materials.

11.1.2 Where stainless steel is used in lubricating oil, hydraulic oil and refrigeration systems, the corrosion allowance may be reduced to 0,3 mm.

11.1.3 In no case is the thickness of austenitic stainless steel pipes to be less than that shown in Table 12.11.1.

Table 12.11.1 Minimum thickness for austenitic stainless steel pipes

Standard pipe sizes (outside diameter) in mm	Min. thickness in mm
10,2 to 17,2	1,0
21,3 to 48,3	1,6
60,3 to 88,9	2,0
114,3 to 168,3	2,3
219,1	2,6
273,0	2,9
323,9 to 406,4	3,6
over 406,4	4,0

Part 5, Chapter 13
Ship Piping Systems

Effective date 1 January 2010

■ *Section 9*
Additional requirements relating to fixed pressure water spray fire-extinguishing systems

9.1 Bilge drainage requirements

9.1.4 On ships with closed vehicle spaces, ro-ro spaces and special category spaces, means are to be provided to prevent the blockage of drainage systems from these spaces.

Part 6, Chapter 1
Control Engineering Systems

Effective date 1 January 2010

■ *Section 3*
Control and supervision of unattended machinery

3.1 General

(Part only shown)

3.1.6 Oil mist ~~monitoring~~ detection, or engine bearing temperature monitors or alternative methods for crankcase protection are to be provided:

NOTES

5. Where engine bearing temperature monitors or alternative methods are provided for the prevention of the build-up of oil mist that may lead to a potentially explosive condition within the crankcase, details are to be submitted for consideration. The submission is to demonstrate that the arrangements are equivalent to those provided by oil mist ~~monitoring~~ detection ~~or engine bearing temperature monitors~~, *see* ~~Pt 5, Ch 2,6.9.14~~ Pt 5, Ch 2,6.8.14.

3.2 Oil engines for propulsion purposes

Table 1.3.1(a) Oil engines for propulsion purposes: Alarms and slowdowns
(*Part only shown*)

Item	Alarm	Note
Cylinder lubricator flow	Low	One sensor per lubricator unit. Slowdown (automatic on medium and high speed engines)
Thrust bearing temperature*	High	Slowdown
Common rail servo oil pressure	Low	
Oil fuel temperature or viscosity*	High and Low	Heavy oil only
Oil fuel high pressure piping*	Leakage	*See* 3.1.5
Common rail fuel oil pressure	Low	
Turbocharger lubricating oil inlet pressure	Low	If system not integral with turbocharger
Turbocharger lubricating oil outlet temperature	High	Each bearing, if system not integral with turbocharger. *See* Note 7
Direction of rotation	Wrong way	Reversible engines, *see also* 3.2.7
~~Overspeed*~~	~~High~~	~~*See also* Pt 5, Ch 2,5~~
NOTES 7. Where the outlet temperature for each bearing cannot be measured due to the design, details of alternative proposals in accordance with the turbocharger manufacturer's instructions may be submitted for consideration.		

Table 1.3.1(b) Oil engines for propulsion purposes: Alarms and shutdowns

Item	Alarm	Note
Lubricating oil inlet pressure	2nd stage low	Automatic shutdown of engines (and gearing if fitted), *see* 3.1.4
Oil mist concentration in crankcase or bearing temperature	High	Automatic shutdown of medium and high speed engines, *see* 3.1.6
Cylinder coolant outlet temperature	2nd stage high	Automatic shutdown of medium and high speed engines, *see* 3.1.4
Overspeed	High	Automatic shutdown of engine, *see also* Pt 5, Ch 2,5. Details of alternative proposals in accordance with the manufacturer's instructions may be submitted for consideration

3.9 Auxiliary engines and auxiliary steam turbines

Table 1.3.8 Auxiliary engines and auxiliary steam turbines: Alarms and safeguards
(*Part only shown*)

Item	Alarm	Note
OIL ENGINES		
Oil fuel temperature or viscosity	High and Low	Heavy oil only
Overspeed	High	~~*See*~~ Automatic shutdown of engine, *see also* Pt 5, Ch 2,5. Details of alternative proposals in accodance with the manufaturer's instructions may be submitted for consideration
Common rail servo oil pressure	Low	—
Common rail fuel oil pressure	Low	—
Starting air pressure	Low	—
Electrical starting battery charge level	Low	—

Part 7, Chapter 11
Arrangements and Equipment for Environmental Protection

Effective date 1 January 2010

■ *Section 1*
General requirements

1.2 EP class notation: minimum requirements and additional characters

1.2.2 Section 3 contains additional requirements. Ships complying with these requirements will be eligible for one or more of the following associated supplementary characters, as applicable:

A	Anti-fouling coatings.
B, Bt	Ballast water management.
Crm	Cargo residue minimisation.
Ede	Energy efficiency design index.
Eop	Energy efficiency operational indicator.
G	Grey water.
I	Inventory of hazardous materials.
~~**N**~~ **N_1, N_2, N_3, N_e**	Oxides of nitrogen (NO_x) exhaust emissions.
O	Oily bilge water.
P	Protected oil tanks.
R	Refrigeration systems.
S	Oxides of sulphur (SO_x) exhaust emissions.
Sp	Swimming pool water.
Tc	Enhanced tank cleaning.
~~**V**~~ **Vc, Vp**	Vapour emission control systems (tankers only).

1.3 Information to be submitted

1.3.1 The following are to be submitted:

(a) One copy of all plans and information listed in ~~1.3.4~~ 1.3.5.

(b) Two copies of the Operational Procedures listed in ~~1.3.3~~ 1.3.4.

(c) One copy of every Certificate listed in ~~1.3.2~~ 1.3.3.

1.3.2 For existing ships the certificates, information and plans listed in 1.3.3 to 1.3.5 are to be submitted for approval prior to the **EP** Initial Survey for assignment of the **EP** notation, *see* 4.1.1. For new ships, information and plans listed in 1.3.3 and 1.3.5 are to be submitted for approval prior to the **EP** Initial Survey. However, the operational procedures listed in 1.3.4 may be submitted up to six months after the ship enters into service.

~~*1.3.2*~~ *1.3.3* Certificates:

(a) MARPOL certificates, as applicable.

(b) Safety Management Certificate (SMC) and Document of Compliance (DOC) in accordance with the International Safety Management Code (ISM Code).

(c) ~~Interim~~ Engine International Air Pollution Prevention (EIAPP) Certificate ~~or statement of compliance with the NO_x emission requirements of MARPOL Annex VI~~ for each engine.

(d) Incinerator certificate or statement of compliance with the requirements of MARPOL Annex VI, Regulation 16.

(e) TBT-free antifouling paint certificate.

(f) Sewage system and, where fitted, sewage treatment system statement of compliance with the requirements of USCG 33 CFR 159 and/or MARPOL 73/78 Annex IV.

~~(e)~~(g) Vapour emission control system certificate or statement of compliance with the requirements of USCG 46 CFR 39 or the IMO Standards for Vapour Emission Control Systems (MSC Circular 585) (supplementary character **V** only).

~~*1.3.3*~~ *1.3.4* Operational procedures:

(a) NO_x emission control, as applicable.

(b) Oil fuel management for the control of SO_x emissions.

(c) Refrigerant management including adding and recovering refrigerant charge, leak detection and sample log book.

(d) Retention and disposal of spilled or spent foam, chemical or liquid based fire-fighting media, as applicable.

~~(d)~~(e) Oil pollution prevention measures.

~~(e)~~ (f) Garbage management.

~~(f)~~ (g) Sewage treatment and discharge control.

~~(g)~~(h) Precautionary measures to minimise the transfer of non-native organisms in ballast water.

~~(h)~~(j) Ballast water management, as applicable.

(k) Energy management plan.

(l) Vapour management plan (tankers carrying crude oil, petroleum products or volatile chemical cargoes only).

(m) Grey water treatment or holding and discharge (supplementary character **G** only).

(n) Maintenance of inventory of hazardous materials (supplementary character **I** only).

(o) Neutralisation of chemically disinfected swimming pool or other recreational waters (supplementary character **Sp** only).

~~*1.3.4*~~ *1.3.5* Information and plans:

(a) SERS registration number or statement of membership of alternative scheme from IACS Member service provider.

(b) Details of engine type, rated power and intended use for all installed engines.

(c) Details of NO_x control arrangements, as applicable.

(d) Fuel consumption records.

(e) Emission footprint calculation records.

~~(d)~~(f) ~~Arrangements of~~ Details and location of each permanently installed refrigeration systems (including those used for cargo temperature control, air conditioning, ~~domestic store rooms~~ provision rooms and chiller units).

~~(e) Capacity of refrigeration system.~~

~~(f) Details of intended refrigerant(s).~~

(g) Mass of refrigerant charge in each system and the refrigerant designation (e.g. R-134a) in accordance with ISO 817.

(h) Refrigerant plant general arrangement drawing showing number and locations of the refrigerant leak detectors.

~~(g)~~(j) Details of fire-extinguishing media to be used in fixed fire-fighting systems and portable extinguishers.

~~(h)~~(k) Bilge holding, waste oil and sludge tank capacities and piping arrangements.

~~(j)~~(l) Arrangements of non-cargo oil loading and discharge connections together with associated drip trays and drainage systems.
~~(k)~~(m) Oil fuel storage, settling and service tank high level alarms/overflow systems.
~~(l)~~(n) Cargo and ballast tank arrangements (tankers only).
~~(m)~~(o) Cargo and ballast piping system plans, including cargo tank overfill prevention arrangements (tankers only).
~~(n)~~(p) Arrangements of tanker cargo manifolds together with associated drip trays and drainage systems.
~~(o)~~(q) Details of sewage treatment and handling systems.
~~(p)~~(r) Capacity of sewage holding and/or treatment system.
~~(q)~~(s) Maximum numbers of crew and passengers.
~~(r)~~(t) Details of incinerator arrangements, as applicable, associated piping systems, control and monitoring equipment.
~~(s)~~(u) Hull coating system ~~and leaching rate~~.
~~(t)~~(v) Ballast water treatment arrangements, as applicable (for supplementary ~~**B**~~ **Bt** character only).
(w) Energy Efficiency Design Index calculation records or certificate (supplementary character **Ede** only).
(x) Energy Efficiency Operational Indicator calculation records (supplementary character **Eop** only).
~~(v)~~(y) Details of grey water treatment plant and effluent quality (for supplementary **G** character only).
(z) Inventory of hazardous materials (supplementary character **I** only).
~~(u)~~(aa) Arrangements for protected oil tanks (for supplementary **P** character only).
(ab) Shadow area diagrams (supplementary character **Tc** only).
~~(w)~~(ac) Details of self-contained vapour recovery systems, where fitted (for supplementary ~~**V**~~ **Vp** character only).
~~(x)~~(ad) Any information relating to the environmental performance of the ship, which may influence the assignment of the **EP** notation.

~~**1.5 In-service records**~~

~~*1.5.1* Records demonstrating the effective implementation of the operational procedures specified in 1.3.3, as applicable, are to be maintained.~~

~~*1.5.2* These records are to be kept on board for a minimum period of three years, in a readily accessible form, and are to be available for inspection by LR Surveyors, as required.~~

1.5 Definitions

1.5.1 The following definitions are applicable:
Antifouling Convention means the International Convention on Control of Harmful Anti-fouling Systems on Ships. This Convention prohibits the use of organotin antifouling systems on ships and was adopted by the International Maritime Organization (IMO) in October 2001.
Ballast Water Convention means the International Convention for the Control and Management of Ships' Ballast Water and Sediments. This international legislation was developed by the IMO to regulate discharges of ballast water and reduce the risk of introducing non-native species from ships' ballast water.
Geometric mean means the n^{th} root of the product of *n* numbers.
Grey water is drainage from dishwater, shower, laundry, bath and washbasin drains and excludes drainage from hospitals.
Leakage detection system means a calibrated mechanical, electrical or electronic device for detecting leakage of refrigerant gases which, on detection, alerts the operator.
MARPOL or MARPOL 73/78 is the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978.
Operator means the natural or legal person exercising actual power over the technical functioning of the equipment and systems.
Refrigerant system log book means a method of maintaining a record of maintenance, calibration, refrigerant charging, leak detection, recovery etc. The log book may take the form of a stand-alone book, a series of log sheets or form part of the engine room log.
Thermotolerant coliforms are the group of coliform bacteria which produce gas from lactose in 48 hours at 44,5°C. Also referred to as 'faecal coliforms'; however, the term 'thermotolerant coliforms' is now accepted as more appropriate, since not all of these organisms are of faecal origin.
VECS means vapour emission control system.
VOC means volatile organic compound.

■ *Section 2* Environmental Protection (EP) class notation

2.1 General

(Part only shown)
2.1.1 It is a prerequisite for assignment of the **EP** notation that the ship:
(a) complies with the Antifouling Convention, the Ballast Water Convention and all adopted Annexes of MARPOL, whether ratified or not, relevant to the ship;

2.1.3 Where a ship, by virtue of its gross tonnage, is not required by the Antifouling Convention to have certification, an antifouling system (AFS) declaration in the format shown in Appendix 2 of Annex 4 to the Convention is to be maintained onboard.

2.1.4 Where a ship, by virtue of its gross tonnage, is not required by the Ballast Water Convention to have certification, a ballast water management plan and record book are to be maintained onboard.

~~*2.1.3*~~ *2.1.5* Where a ship, by virtue of its gross tonnage is not required to have a SMC, it is exempt from ~~this requirement~~ 2.1.1(b).

~~*2.1.4*~~ *2.1.6* High speed craft, as defined in LR's *Rules and Regulations for the Classification of Special Service Craft,* will be the subject of special consideration.

2.2 Oxides of nitrogen (NO_x)

2.2.1 These requirements apply to all installed diesel engines with an individual output power greater than 130 kW, other than those used solely for emergency purposes on the ship on which the engine is installed. There are no specific requirements relating to NO_x emissions from boilers, incinerators or gas turbine installations.

2.2.2 All engines falling within the scope of MARPOL Annex VI, Regulation 13 are to comply with its provisions and ~~be certified accordingly. Certification is to be issued by a Flag State Administration or a duly authorised organisation, complying with IMO Resolutions A739(18) and A789(19)~~ meet the NO_x emission limits applicable to the date of construction of the ship.

2.2.3 Certification is to be issued by a Flag State Administration or a duly authorised organisation, complying with IMO Resolutions A739(18) and A789(19).

2.2.4 Alternative arrangements providing an equivalent level of environmental protection will be considered.

~~*2.2.3* Engines over 130 kW, other than those used solely for emergency purposes, not falling under the requirements of MARPOL Annex VI, Regulation 13, are also to comply with the applicable emission values detailed in paragraph 3(a) of that Regulation. The test procedure and measurement method are to be in accordance with either the Simplified Measurement Method or Direct Measurement and Monitoring Method as detailed in Chapter 6 of the NO_x Technical Code.~~

~~*2.2.4* Where the NO_x emission limits specified in MARPOL Annex VI, Regulation 13 are exceeded, an emission reduction plan is to be developed and agreed with LR.~~

~~*2.2.5* Equipment and systems used to control NO_x emission levels are to:~~

~~(a) be arranged so that failure will not prevent continued safe operation of the engine;~~
~~(b) be operated in accordance with manufacturer's instructions;~~
~~(c) be designed, constructed and installed to ensure structure integrity and freedom from significant vibration;~~
~~(d) be designed to include adequate hatches for inspection and maintenance purposes; and~~
~~(e) be instrumented to record operation. Records of operation and the degree of control are to be maintained.~~

~~Alternative control arrangements will be given special consideration.~~

~~*2.2.6* Procedures covering the use and maintenance of the equipment and systems specified in 2.2.5 are to be established and effectively implemented. Records are to be maintained which demonstrate the operation of the equipment and systems and the resultant level of NO_x emissions to the atmosphere.~~

2.3 Oxides of sulphur (SO_x)

2.3.1 Emissions of SO_x ~~is~~ are to be controlled by limiting the sulphur content of oil fuels used on board.

2.3.2 The maximum sulphur content of oil fuel to be used on board ~~will be dependent upon area of operation and bunkering ports. The maximum permissible fuel sulphur content will not exceed 3,5 per cent~~ is not to exceed 3,0 per cent m/m.

2.3.4 An oil fuel management system is to detail the maximum sulphur content to be specified when ordering oil fuels and the means adopted to verify that the sulphur content of oil fuels supplied meets that requirement. This management system is to include the practices to be adopted to ensure that appropriate low sulphur oil fuels are used when the ship is within IMO designated 'Emission Control Areas' and/or the jurisdiction of other local, national or regional SO_x Emission Control ~~Areas~~' regimes, as applicable.

2.3.5 Where testing to determine the sulphur content of fuel received on board is to be carried out, a representative sample is to be drawn at the time of delivery from the ship's bunker manifold using the manual or automatic sampling methods defined in ISO 3170 or 3171, or their national respective equivalents. Fuel sulphur content is to be subsequently determined using the laboratory test method ISO 8754 ~~or an equivalent National Standard based on ISO 8754~~: *Determination of sulphur content – Energy-dispersive X-ray fluorescence spectrometry*.

2.3.6 Alternative arrangements providing an equivalent level of environmental protection will be considered.

2.4 Energy management

2.4.1 An energy management plan is to be developed and implemented in accordance with the relevant IMO or OCIMF Energy Efficiency and Fuel Management recommendations.

2.4.2 The energy management plan and relevant records to demonstrate compliance are to be retained onboard.

2.4.3 For new ships, the energy management plan is to be available on delivery.

2.5 Fuel consumption and emissions footprint

2.5.1 Annual fuel consumption is to be established for existing ships and for new ships at the end of their first year in service. Fuel consumption is to be based on bunker delivery notes complying with MARPOL Annex VI, Regulation 18.

2.5.2 The annual emissions of NO_x, SO_x and CO_2 in the exhaust gas are to be calculated using relevant monitoring and/or calculation methods acceptable to LR.

2.5.3 Relevant records to demonstrate amounts and methods of measurement or estimation are to be retained onboard the vessel.

~~2.4~~ 2.6 Refrigeration systems

~~2.4.1~~ *2.6.1* These requirements apply to all permanently installed refrigeration and air conditioning installations on ~~all ships~~ board. ~~This includes refrigeration installations on conventional refrigerated cargo ships, container ships carrying produce in containers cooled by ducted air, and gas carriers fitted with reliquefaction plants~~. These requirements do not apply to ~~the domestic~~ stand-alone refrigerators, freezers and ice makers used in galleys, pantries, bars and crew accommodation.

~~2.4.2~~ *2.6.2* The use of chlorofluorocarbons (CFC) in existing, and hydrochlorofluorocarbons (HCFCs) in new, refrigeration or air conditioning installations is prohibited.

2.6.3 If halocarbon refrigerants are used, they are to have an Ozone Depleting Potential (ODP) rating of zero and a Global Warming Potential (GWP) of less than 1950, based on a 100-year time horizon.

~~2.4.3~~ *2.6.4* Systems are to be arranged with suitable means of isolation so that maintenance, servicing or repair work may be undertaken without releasing the refrigerant charge into the atmosphere. Unavoidable minimal releases are acceptable when using recovery units.

~~2.4.4~~ *2.6.5* For the purposes of refrigerant recovery, the compressors are to be capable of evacuating a system charge into a liquid receiver. Additionally, recovery units are to be provided to evacuate a system either into the existing liquid receiver or into cylinders dedicated for this purpose. The number of cylinders is to be sufficient to contain the complete charge between points of isolation in the system.

~~2.4.5~~ *2.6.6* Where different refrigerants are in use they are not to be mixed during evacuation of systems.

~~2.4.6~~ *2.6.7* Refrigerant leakage is to be minimised by leak prevention and periodic leak detection procedures. The ~~annual refrigerant leakage rate for each system shall be less than 10 per cent of its total charge~~ frequency of leak detection and the maximum allowable annual leakage rate is dependant on the charge of each system and is specified in Table 11.2.1.

Table 11.2.1 Refrigerant leak testing – maximum periodicity

Charge size	Periodicity	Leakage
under 3 kg	6 months	10%
3–30 kg	3 months	10%
30–300 kg	Monthly	5%
Over 300 kg	Monthly	<3%

2.6.8 Records are to be maintained demonstrating that leak testing is carried out in accordance with the periodicity specified in Table 11.2.1 by qualified personnel holding relevant certification, using either direct or indirect measuring methods and calibrated instruments where applicable.

~~2.4.7~~ *2.6.9* A leak detection system appropriate to the ~~applicable~~ refrigerant is to be provided to monitor continuously the spaces into which the refrigerant could leak. An alarm is to be ~~given~~ activated to give warning in a permanently manned location when the concentration of refrigerant in the space exceeds a predetermined limit, (25 ppm for ammonia; 300 ppm for halogenated fluorocarbons). Remedial measures to repair the leakage are to be implemented as soon as practicable after an alarm is activated. Each leak detection system is to be checked at least once every 12 months to ensure proper functionality. The system is to be maintained and calibrated in accordance with the manufacturer's recommendations and recorded in the log book.

~~2.4.8~~ *2.6.10* ~~Procedures detailing the means to be adopted to control the loss, leakage, venting and disposal of refrigerants are to be established and implemented effectively.~~ Procedures for refrigerant management including adding and recovering refrigerant charge, leak detection and the means adopted to control the loss and leakage of refrigerants are to be established and implemented effectively.

~~2.4.9~~ *2.6.11* Refrigerant inventory and log book records are to be maintained covering:

(a) Refrigerant added to each system.
(b) Refrigerant leaks, including remedial actions.
(c) Refrigerant recovered and ~~where stored~~ storage location.
(d) Refrigerant disposal including quantity and location.
(e) Details of personnel suitably experienced or with an applicable qualification for maintenance of the onboard refrigerant system(s), including relevant certification.

2.6.12 After a leak has been identified, repaired and recorded it is to be rechecked prior to the system entering normal service. All applications, independent of charge size, are to be checked for leakage within one month after a leak has been repaired to ensure that the repair remains effective.

2.6.13 Records demonstrating the effective implementation of the operational procedures specified in 2.6.10, as applicable, are to be maintained. These records are to be kept on board for a minimum period of three years, in a readily accessible form, and are to be available for inspection by LR Surveyors, as required.

2.6.14 A refrigerant log book is to be maintained for the lifetime of the system. It must record the quantity and type of refrigerant installed and the quantities added and recovered during servicing, maintenance and final disposal.

2.6.15 All personnel involved in the following activities must be suitably experienced or possess an applicable qualification:

(a) installation, servicing or maintenance of the refrigeration equipment covered by the **EP** Notation;
(b) checking such equipment for any leakages of refrigerant gases; or
(c) repairing, or carrying out work to prevent, such leakages.

~~2.5~~ 2.7 Fire-fighting systems

~~2.5.1~~ *2.7.1* The use of halon or halo-carbons as the fire-extinguishing medium in fixed fire-fighting systems or portable extinguishers is not permitted.

2.7.2 Where foam concentrates or other chemical or liquid based fire-fighting media with the potential to cause environmental pollution are used, instructions and procedures are to be provided for the safe containment and disposal of spilled media and other contaminated products during routine maintenance and, where practicable, following emergency use.

~~2.6~~ 2.8 Oil pollution prevention

~~2.6.1~~ *2.8.1* All ships are to comply with the requirements of ~~2.6.2 to 2.6.11~~ 2.8.2 to 2.8.12. In addition, tankers are to comply with the requirements of ~~2.6.12 to 2.6.18~~ 2.9.

~~2.6.2~~ *2.8.2* Drainage from machinery space bilges ~~may~~ is to be discharged to sea in accordance with the requirements of MARPOL 73/78, Annex I or retained onboard for discharge ashore.

~~2.6.3~~ *2.8.3* The oil-in-water content of the water discharged is to be less than 15 ppm. Oily bilge water is to be discharged through approved oil filtering equipment and a 15 ppm alarm combined with a device for automatically stopping any discharge to sea when the oil content in the discharge exceeds 15 ppm. Full records of all discharges are to be kept.

~~2.6.4~~ *2.8.4* ~~Oil fuel, lubricating oil and other oil loading or discharge connections on deck are to be fitted with drip trays.~~ The loading or discharge connections and vent pipes/overflows associated with oil fuels, lubricating oils, hydraulic oils and other oils are to be fitted with drip trays. Drip trays are to be fitted with closed drainage systems except on tankers where alternative arrangements will be considered.

~~2.6.5~~ *2.8.5* Oil fuel storage, settling and service tanks are to be fitted with high level alarms and/or acceptable overflow systems.

~~2.6.6~~ *2.8.6* Leakages and waste oil from machinery and equipment are to be collected in a dedicated waste oil tank prior to disposal ashore or incineration. This waste oil tank is to be separate from the sludge tank specified in MARPOL Annex I, Regulation 2. The volume of the waste oil tank is to be of sufficient capacity to hold a complete lubricating oil charge from the largest engine used for propulsion or electrical generating purposes.

~~2.6.7~~ *2.8.7* For those ships which only operate on distillate fuel, the waste oil and sludge tanks may be combined to form a single tank. Where such a combined tank is fitted, the total capacity is to be equal to or greater than the aggregated total of the required individual tank capacities.

~~2.6.8~~ *2.8.8* The bilge holding tank, the waste oil tank and the sludge tank are to be arranged to facilitate the periodic removal of accumulated sediments and other material.

~~2.6.9~~ *2.8.9* Discharge piping systems to deck from the bilge holding tank, and the waste oil tank, are to be separate from the oil fuel loading and transfer systems. The bilge holding tank and waste oil tank piping systems are to be terminated with the standard discharge connections specified in MARPOL Annex I, Regulation 13. ~~The sludge tank may be discharged through the same piping system as the waste oil tank.~~

~~2.6.10~~ *2.8.10* Means are to be provided for the collection and recovery of any oil spilled on decks.

2.8.11 For ships delivered after 1 August 2010, all oil fuel tanks with a capacity of greater than 60 m^3 are to be located in a protected location away from the ship's side or bottom shell plating. The location of tanks is to be in accordance with the requirements relating to oil fuel tank protection given in MARPOL Annex I, Regulation 12A.

~~2.6.11~~ *2.8.12* Procedures covering the handling of all oils and oily wastes are to be established and implemented effectively. As a minimum, these are to cover:

(a) loading, storage and transfer of oil fuels, lubricants, hydraulic oil, thermal heating oil and drummed oil products;
(b) storage, transfer, discharge and disposal of oily mixtures contained in the ship's sludge, bilge holding and waste oil tanks and machinery space bilges; ~~and~~
(c) recovery of any oil spilled on decks~~.~~; and
(d) prevention of leakage of fuel and lubricating oils during fuel changeovers in accordance with Regulation 14(6) of MARPOL Annex VI.

2.9 Arrangements on ships carrying oil cargoes in bulk

~~2.6.12~~ *2.9.1* The constructional requirements of MARPOL Annex I, Regulations 19 and 20 as applicable, are to apply to all oil tankers greater than 600 tonnes deadweight.

~~2.6.13~~ *2.9.2* Cargo tanks are to be fitted with high level alarms and/or acceptable overflow systems.

~~2.6.14~~ ~~The cargo tanks are to be fitted with arrangements to prevent the possible outflow of oil under overfilling conditions~~.

2.9.3 The cargo area is to have arrangements to collect accidental outflow of oil under overfilling conditions. Accidental oil spills are to be discharged to a slop tank or collecting tank. These tanks are not be located in the double hull space.

~~2.6.15~~ *2.9.4* Cargo tank ballasting arrangements and segregated ballast systems are to be connected to separate and distinct sea chests.

~~2.6.16~~ *2.9.5* A screw-down non-return valve is to be provided to isolate the cargo piping system from the sea connections.

~~2.6.17~~ *2.9.6* Cargo manifold connections are to be fitted with drip trays with closed drainage systems.

~~2.6.18~~ *2.9.7* Cargo manifold terminal pieces are to be designed, where practicable, in accordance with the relevant Oil Companies International Marine Forum (OCIMF) Recommen-dations for ~~oil~~ tanker manifolds and associated equipment.

2.9.8 Procedures covering ship to ship transfer of bulk liquid cargoes are to be established, agreed with LR, and effectively implemented.

~~2.7~~ 2.10 Garbage handling and disposal

~~2.7.1~~ *2.10.1* ~~Procedures covering garbage management are to be established and effectively implemented. As a minimum, these procedures are to include:~~ A garbage management plan, developed in accordance with IMO MEPC Resolution 71(38), is to be available and effectively implemented. This plan, *inter alia*, shall include:

(a) identification of the sources of garbage;
(b) means of minimising garbage production;
(c) procedures for the safe and hygienic collection, segregation, storing, processing and disposal of garbage, including the use of the equipment (compactors, comminuters, incinerators or other devices) on board. These procedures are to cover all garbage generated during the normal operation of the ship. The disposal of the following materials is to be specifically covered:
    - Cargo residues.
    - Cargo associated wastes.
    - Waste oil.
    - Paint and painting materials.
    - Medical wastes.
    - Large metal objects such as oil drums and machinery components.
    - Ropes: metal, synthetic or natural fibre.
    - Rust/scale debris.
    - Ballast tank sediments.
    - Equipment containing refrigerants.

~~2.7.2~~ *2.10.2* Where fitted, incinerators are to be designed and constructed in accordance with the requirements of IMO Resolution MEPC 76(40). A ~~certificate of compliance~~ type approval certificate issued by LR, another IACS Member or the relevant Flag State Administration is to be provided. As an alternative, a certificate issued under the EU Marine Equipment Directive may be acceptable.

~~2.7.3~~ *2.10.3* Where incineration is to be carried out, procedures are to be developed and implemented covering:

(a) operation in accordance with the requirements of MARPOL Annex VI, Regulation 16; and
(b) prevention of incineration within areas where incineration is prohibited by the Coastal State Administration.

~~2.8~~ 2.11 Sewage treatment

2.11.1 Where fitted, the sewage treatment system is to be approved in accordance with MEPC Resolution 159(55). As an alternative, a certificate issued under the EU Marine Equipment Directive may be acceptable.

~~2.8.1~~ *2.11.2* The capacity of the sewage treatment system~~, where fitted,~~ is to be sufficient for the maximum number of persons on board. Where 'black water' only is treated, the minimum capacity is to be 115 litres/person/day for a conventional flushing system or 15 litres/person/day for a vacuum system. Where both 'black water' and 'grey water' are treated, an additional allowance of 135 litres/person/day is to be made.

Existing paragraphs 2.8.2 to 2.8.5 are to be renumbered 2.11.3 to 2.11.6.

2.11.7 Means are to be provided to aerate holding tanks to prevent the development of anaerobic conditions, taking into account MSC Circular 648.

~~2.8.6~~ *2.11.8* Records are to be maintained detailing discharges from the holding tank. These should include:

(a) the date, location and quantity of sewage discharged from the holding tank either ashore or at sea in accordance with MEPC Resolution.157(55);
(b) rate of discharge of raw sewage;
~~(b)~~(c) distance from land and ship's speed, when sewage is discharged to sea.

~~2.8.7~~ *2.11.9* Ventilation pipes from the sewage system are to be independent of other vent systems.

~~2.8.8~~ *2.11.10* A suitable piping system from the sewage treatment system or holding tank is to be provided to allow discharge from the system/tank to shore reception facilities. The systems discharge pipe is to terminate with a standard discharge connection complying with the requirements of MARPOL Annex IV, Regulation 10.

2.11.11 Procedures for the cleaning and safe entry of sewage treatment systems and holding tanks, including the use of suitable personal protective equipment, are to be provided and implemented effectively.

~~2.9~~ 2.12 Hull anti-fouling systems

2.12.1 The application of anti-fouling systems containing TBT is prohibited.

~~2.9.1 Prior to 1 January 2003, the application of anti-fouling systems containing tributyltin (TBT) is acceptable provided that the leaching rate does not exceed 4 μg/cm^2/day, as determined by ASTM Method 5108-90.~~

~~2.9.2 From 1 January 2003, the application of anti-fouling systems containing TBT is prohibited. Ships to which TBT-based anti-fouling systems have been applied prior to this date will be accepted until 1 January 2008, provided the TBT leaching rate does not exceed 4 μg/cm^2/day, as determined by ASTM Method 5108-90.~~

~~2.10~~ 2.13 Ballast water

~~2.10.1~~ *2.13.1* All ships carrying ballast water are to implement precautionary measures to minimise the translocation of non-native organisms in their ballast water unless it can be demonstrated that the risk of translocation of non-native organisms in their ballast water and sediments is minimal.

~~2.10.2~~ *2.13.2* ~~As a minimum, precautionary~~ Precautionary measures to minimise the translocation of non-native organisms are to encompass the recommendations in IMO Resolution MEPC 127(53) and, as a minimum, are to include:

(a) procedures for minimising the uptake of aquatic organisms, pathogens and sediments during ballasting, by limiting (or minimising) ballasting in situations where the numbers of aquatic organisms are likely to be increased locally. For example:
- in darkness, when bottom-dwelling organisms may rise up the water column;
- in very shallow water;
- in locations where propellers may stir up sediment;
- and/or in areas specified by the Port State for avoidance or restriction of ballasting;

(b) monitoring of sediment build up and, where practical, routine cleaning of ballast tanks to remove sediments;

(c) disposal of sediments;

~~(c)~~(d) planning uptake and discharge of ballast water such that where ballast needs to be taken on and discharged in the same port, discharge of ballast loaded in another port is to be avoided, where practicable.

2.14 VOC management

2.14.1 Tankers carrying crude oil, petroleum products or chemicals having a flash point not exceeding 60°C (closed-cup test) are required to develop and effectively implement a vapour management plan which is to be agreed with LR.

■ *Section 3*
Supplementary characters

3.2 Ballast water management – B, Bt characters

3.2.1 ~~Where ballast water management is undertaken, for~~ For assignment of the **B** character, a ballast water management plan approved by LR, another IACS or Member or the Administration with which the ship is registered, is to be ~~in place~~ onboard and implemented effectively.

3.2.3 For new ships intending to undertake ballast water exchange, the guidance on ballast water exchange design and construction standards within IMO Resolutions MEPC 149(55) ~~and MEPC 150(55)~~ is to be taken account of, ~~as far as is practicable~~ to the satisfaction of LR.

3.2.4 Where a ballast water treatment system is installed, the character **Bt** will be assigned provided that the treatment system is installed, utilised and approved in accordance with MEPC 174(58).

3.2.5 A ballast water record book for the purpose of recording all ballast water operations and use of the treatment system, where applicable, is to be available onboard and maintained.

3.2.6 New ships are to take account of the guidance on design and construction to facilitate sediment control within IMO Resolution MEPC 150(55), as far as is practicable.

3.3 Cargo residue minimisation – Crm character

3.3.1 For assignment of the **Crm** character, cargo residue is to be minimised.

3.3.2 In accordance with MARPOL Annex II, Resolution 12.3, individual cargo tanks are not to retain more than 60 litres of residue in the tank and associated piping.

3.3.3 A performance test is to be conducted in accordance with appendix 5 of MARPOL Annex II and a record of the test results retained on board.

3.4 Energy Efficiency Design Index – Ede

3.4.1 For assignment of the **Ede** character, the Energy Efficiency Design Index is to be established in accordance with the IMO Interim Guidelines on the Method of Calculation of the Energy Efficiency Index for New Ships.

3.5 Energy Efficiency Operational Indicator – Eop

3.5.1 For assignment of the **Eop** character, the ship Energy Efficiency Operational Indicator is to be established in accordance with the IMO Guidelines for voluntary use of the Ship Energy Efficiency Operational Indicator.

3.5.2 The index is to be based on annual data and calculated as a one year rolling average, as applicable.

3.5.3 Records should be retained to show the calculation methodology.

~~3.3~~ 3.6 Grey water – G character

~~3.3.1~~ *3.6.1* ~~Where~~ For assignment of the **G** character where a plant for the treatment of grey water is installed ~~and utilised effectively, the **G** character will be assigned, subject to the plant effluent meeting the standards~~, the plant discharge effluent is to meet the standards specified in ~~3.3.2~~ 3.6.2 or ~~3.3.3~~ 3.6.3, as applicable. The **G** character will also be assigned where grey water is retained onboard in dedicated holding tank(s) for discharge ashore, subject to the requirements specified in 3.6.4 to 3.6.9 being met.

~~3.3.2~~ *3.6.2* Where it is not intended that the effluent is recycled or re-used for any purpose, the effluent of the grey water treatment plant is to meet the following standards:

~~(a) Faecal coliforms: Content is not to exceed 250/100 ml M.P.N. (most probable number) as determined by a multiple tube fermentation analysis or an equivalent procedure.~~

(a) Thermotolerant coliforms:
The geometric mean of the thermotolerant coliform count of samples of effluent taken during a test period is not to exceed 100 thermotolerant coliforms/100 ml as determined by membrane filter, multiple tube fermentation or an equivalent analytical procedure.

(b) Total Suspended solids:
- Where the equipment is tested onshore, the geometric mean of the total suspended solids content of the samples of effluent taken during the test period is not to exceed ~~50~~ 35 mg/l.

- Where the equipment is tested onboard the ship, the geometric mean of the total suspended solids content of the samples of effluent taken during the test period is not to exceed the suspended solids content of the ambient (flushing) water used onboard plus ~~100~~ 35 mg/l.
- The method of testing is to be as given in Resolution MEPC.159(55).

(c) Biochemical Oxygen Demand (BOD_5) and chemical oxygen demand (COD):

- The geometric mean of a 5-day Biochemical Oxygen Demand (BOD_5) is not to exceed ~~50~~ 25 mg/l. The chemical oxygen demand (COD) is not to exceed 125 mg/l. Test methods are to be ISO 15705:2002 for COD and ISO 5815-1:2003 for carbonaceous BOD_5 or other internationally accepted equivalent test standards.
- ~~When testing onboard the ship, if insufficient time is available for obtaining a number of samples over a period of days, a BOD_5 not exceeding 100 mg/l on a single sample will be accepted providing that suspended solids are within the value stated above.~~

(d) pH: The pH of the samples of effluent taken during the test period is to be between 6 and 8,5.

(e) Zero or non-detected values: For thermotolerant coliforms, zero values are to be replaced with a value of 1 thermotolerant coliform/100 ml to allow the calculation of the geometric mean. For total suspended solids, BOD_5 and COD values below the limit of detection are to be replaced with one half the limit of detection to allow the calculation of the geometric mean.

~~*3.3.3*~~ *3.6.3* Where it is intended that the effluent of the grey water treatment plant is to be re-used or recycled for any purpose, the effluent is to meet the potable water quality standards of the Flag or Port State Administration, as appropriate.

3.6.4 As an alternative to treatment, where grey water is retained onboard in dedicated holding tank(s) for discharge ashore the holding tank(s) is to be of adequate capacity taking into account the operation of the ship, the number of persons on board and other relevant factors. Each tank is to be fitted with a means to open the tank, means to verify visually the contents of the tank and a high level alarm. *See* 2.11.2.

3.6.5 Means are to be provided to aerate the tanks to prevent the development of anaerobic conditions, taking into account IMO Circular MSC/648.

3.6.6 Ventilation pipes from the grey water treatment system and, where provided, from holding tank(s) are to be independent of other ventilation systems.

3.6.7 A suitable piping system from the grey water treatment system or holding tank(s) is to be provided to allow discharge to shore reception facilities. The discharge pipe is to terminate with a standard discharge connection complying with the requirements of MARPOL Annex IV, Regulation 10. Any connection from the grey water system to the sewage discharge is to be via a screw down non-return valve.

3.6.8 Records of grey water treatment and/or discharge are to be maintained. A single record book may be utilised for both grey water and sewage records. Records detailing discharges from the holding tank(s) are to include:

(a) the date, location and quantity of grey water discharged from the holding tank(s) either ashore or at sea;

(b) rate of discharge of untreated grey water;

(c) distance from land and ship's speed, when untreated grey water is discharged to sea.

3.6.9 Procedures for the cleaning and safe entry of grey water treatment systems and holding tanks, including the use of suitable personal protective equipment, are to be provided and implemented effectively.

3.7 Inventory of hazardous materials – I character

3.7.1 For assignment of the I character, the ship is to possess an inventory of hazardous materials in compliance with Regulation 5 of the IMO *Convention for the Safe and Environmentally Sound Recycling of Ships*.

3.7.2 The inventory is to be independently verified by LR.

3.7.3 Procedures covering maintenance of the inventory of hazardous materials throughout the ship's life are to be established and effectively implemented. The procedures are to address, *inter alia*, new installations containing hazardous materials specified in appendices 1 and 2 of the *Convention for the Safe and Environmentally Sound Recycling of Ships* and relevant changes in the ship's structure and equipment.

~~3.4~~ 3.8 Oxides of nitrogen (NO_x) – ~~N~~, N_1, N_2, N_3 characters

~~*3.4.1*~~ *3.8.1* For assignment of the ~~N~~ **N_1** or **N_2** character, the total weighted value of NO_x emissions from all installed diesel engines defined within 2.2.1 is not to exceed 80 per cent of the total weighted NO_x emission limits specified in MARPOL Annex VI, Regulation 13, applicable to the date of construction of the ship.

~~*3.4.2*~~ *3.8.2* The total weighted emission value for the ship (*WV*) is to be calculated as follows:

$$WV_{[ship]} = \frac{WAEV_{[cert]}}{WAEV_{[IMO]}}$$

where

$$WAEV_{[cert]} = \frac{\sum_{n=1}^{n} (NO_{x[cert]}.P}{\sum_{n=1}^{n} (P)}$$

$$WAEV_{[IMO]} = \frac{\sum_{n=1}^{n} (NO_{x[IMO]}.P}{\sum_{n=1}^{n} (P)}$$

n = the number of individual engines on board the ship

P = the rated power, in kW, of each individual installed engine

$NO_{x[cert]}$ = the certified NO_x emission value, in g/kWh, for each individual engine

$NO_{x[IMO]}$ = the NO_x emission limit value~~, in g/kWh,~~ of each individual engine, in g/kWh, applicable at the date of construction of the ship, as specified in Regulation 13 of Annex VI to MARPOL.

~~*3.4.3*~~ *3.8.3* ~~The~~ **~~N~~** For ships constructed before 1 January 2011, the $\mathbf{N_1}$ character will be assigned when:

$$\frac{WAEV_{[cert]}}{WAEV_{[IMO]}} \leq 0{,}8$$ MARPOL Annex VI Tier 1 NO_x emission limits

For ships constructed on or after 1 January 2011, the $\mathbf{N_2}$ character will be assigned when:

$$\frac{WAEV_{[cert]}}{WAEV_{[IMO]}} \leq 0{,}8$$ MARPOL Annex VI Tier 2 NO_x emission limits.

~~*3.4.4 The test procedure and measurement method are to be in accordance with either the Simplified Measurement Method or Direct Measurement and Monitoring Method given in Chapter 6 of the IMO NO_x Technical Code.*~~

~~*3.4.5 Systems and equipment used to control the NO_x emissions are to comply with the requirements specified in 2.2.5.*~~

3.8.4 For assignment of the $\mathbf{N_3}$ character, engines and associated NO_x emission abatement systems are to be certified as meeting the Tier 3 NO_x emission limits specified in MARPOL Annex VI, Regulation 13.

3.8.5 Equipment and systems used to control NO_x emission levels are to:

(a) be arranged so that failure will not prevent continued safe operation of the engine;
(b) be operated in accordance with manufacturer's instructions;
(c) be designed, constructed and installed to ensure structure integrity and freedom from significant vibration;
(d) be designed to include adequate hatches for inspection and maintenance purposes; and
(e) be instrumented to record operation. Records of operation and the degree of control are to be maintained.

Alternative control arrangements will be given special consideration.

3.8.6 Procedures covering the use and maintenance of the equipment and systems specified in 3.8.1 are to be established and effectively implemented. Records are to be maintained which demonstrate the operation of the equipment and systems and the resultant level of NO_x emissions to the atmosphere.

3.8.7 Where engines are not certified in accordance with MARPOL Annex VI, the test procedure and measurement method are to be in accordance with either the Simplified Measurement Method or Direct Measurement and Monitoring Method given in Chapter 6 of the IMO NO_x Technical Code.

~~*3.4.6*~~ *3.8.8* In the case where the individual engines are 'family' or 'group' engines, as defined in the NO_x Technical Code, the certified emission value may be based on that of the parent engine.

3.9 Oxides of nitrogen (NO_x) – N_e character

3.9.1 The $\mathbf{N_e}$ character will be assigned to ships constructed before 1 January 2000, when the NO_x emissions from installed diesel engines over 130 kW, other than those used solely for emergency purposes, meet the Tier 1 NO_x emission limits specified in MARPOL Annex VI, Regulation 13.

~~3.5~~ 3.10 Oily bilge water – O character

~~*3.5.1*~~ *3.10.1* For assignment of the **O** character, all drainage from machinery space bilges is to be discharged ashore, except under exceptional circumstances.

3.10.2 Adequate capacity for storage of oily bilge water between discharges ashore is to be provided.

~~*3.5.2*~~ *3.10.3* Alternatively, discharge to sea is permitted where it can be demonstrated that the oil-in-water content of the water discharged is less than 5 ppm.

3.10.4 The oily water separator is to be recalibrated or retested every five years by the manufacturer or other acceptable alternative and full records of the recalibration or retesting are to be kept onboard.

~~*3.5.3*~~ *3.10.5* Full records of all discharges are to be kept.

~~3.6~~ 3.11 Protected oil tanks – P character

~~*3.6.1*~~ *3.11.1* For assignment of the **P** character, in addition to compliance with the requirements of 2.8.11, all oil fuel ~~and~~ , lubricating oil and hydraulic oil tanks are to be located in a protected location away from the ship's side or bottom shell plating.

~~*3.6.2*~~ *3.11.2* The location of the oil fuel, lubricating oil and hydraulic oil tanks is to be in accordance with the requirements relating to oil fuel tank protection given in ~~IMO Resolution MEPC.141(54)~~ MARPOL Annex I, Regulation 12A.

~~*3.6.3*~~ *3.11.3* ~~The requirements apply to oil fuel and lubricating oil tanks.~~ Main engine lubricating oil drain tanks are excluded.

~~*3.6.4*~~ *3.11.4* Arrangements providing equivalent protection will be given special consideration.

~~*3.6.5*~~ *3.11.5* Suction wells may protrude below oil fuel tanks provided they are as small as possible and the distance between the tank bottom and the ship's bottom shell plating is not reduced by more than 50 per cent.

~~3.7~~ 3.12 Refrigeration systems – R character

~~*3.7.1 For assignment of the **R** character, in addition to compliance with the requirements of 2.4, all refrigerants used onboard are to have an Ozone Depleting Potential (ODP) rating of zero and a Global Warming Potential (GWP) of less than 1950, based on a 100 year time horizon.*~~

3.12.1 For assignment of the **R** character, natural substances are to be used as the refrigerants in all main refrigeration systems such as cargo systems, provision rooms and air conditioning.

3.12.2 Small factory-built refrigeration system(s) that use fluorinated refrigerants, having a Global Warming Potential (GWP) of less than 1950 are allowable.

3.12.3 The GWP value is based on the 100-year time horizon.

~~3.8~~ 3.13 Oxides of sulphur (SO_x) – S character

~~*3.8.1*~~ *3.13.1* For assignment of the **S** character, ~~all gas oil used onboard is to have a sulphur content of less than 0,20 per cent m/m. All heavy fuel oil is to have a sulphur content of less than 1,5 per cent m/m~~ all fuel used onboard is to be:

(a) distillate with a sulphur content of less than 0,1 per cent m/m; or

(b) an alternative fuel or a hybrid fuel management solution which achieves the equivalent emission limit to 0,1 per cent sulphur m/m.

~~*3.8.2*~~ *3.13.2* The sampling, fuel sulphur analysis methods and verification requirements stipulated in 2.3.4 and 2.3.5 are to be complied with.

3.14 Swimming pool water – Sp character

3.14.1 For assignment of the **Sp** character, swimming pool or other recreational water which has been treated with a chemical disinfectant, is to be neutralised prior to discharge overboard where residual disinfectant has the potential to be present.

3.14.2 Procedures covering the neutralisation process specified in 3.14.1 are to be established and implemented effectively. Records are to be maintained to demonstrate neutralisation of chemically disinfected swimming pool or other recreational waters prior to discharge overboard.

3.15 Enhanced tank cleaning – Tc character

3.15.1 For the assignment of the **Tc** character, oil and chemical tankers are to be provided with tank washing equipment meeting the standards specified in 3.15.2 to 3.15.8.

3.15.2 Cargo tanks are to be served by individual pumps.

3.15.3 Permanent tank washing machines, of a design and method of support acceptable to LR, are to be installed in each cargo tank.

3.15.4 At the design stage the following minimum procedures are to be used to determine the area of the tank surface covered by direct impingement (longitudinals, brackets, stiffeners, ladders, pipework, corrugations on corrugated bulkheads and face plates can be ignored):

(a) using suitable structural plans, lines are set out from the tips of each machine to those parts of the tank within the range of the jets; or

(b) a pinpoint of light simulating the tip of the tank washing machine in a scale model of the tank are to be used.

Alternative methods of measurement will be considered.

3.15.5 Additional tank washing equipment, which may be portable, is also to be provided to enable washing of the shadow areas without the necessity to enter the tanks. The use of portable machines to wash the shadow areas is not to be undertaken where the last cargo in the tank has toxic or low ignition properties, reacts with water or has other properties specified in chapter 15 of the *International Bulk Chemical Code* which would prevent water washing or opening of the tank to allow the use of portable washing machines.

3.15.6 A back-up system to provide cleaning capability in the event of failure of one tank washing machine is to be provided.

3.15.7 Heating equipment is to be provided for tank washing equipment which achieves a minimum temperature of 85°C at the connection to the tank washing machine.

3.15.8 The effectiveness of the tank washing system is to be confirmed by tank inspections or other means as required by LR. The confirmation is to be carried out when the ship is in service. For ships fitted with crude oil washing system(s) the confirmation will be carried out as part of the MARPOL Annex **I** survey and need not be carried out separately.

~~3.9~~ 3.16 Vapour emission control systems – Vc and Vp characters

~~*3.9.1*~~ *3.16.1* For assignment of the **Vc** or **Vp** character, tankers ~~Tankers~~ carrying crude oil, petroleum products or chemicals having a flash point not exceeding 60ºC (closed-cup test) will be assigned the **Vc** or **Vp** character provided the provisions of either ~~3.9.2~~ 3.16.2 or ~~3.9.3~~ 3.16.3 are complied with.

~~*3.9.2*~~ *3.16.2* For assignment of the **Vc** character, a vapour emission control system is to be fitted~~. The system is to be~~ which has been designed and constructed in accordance with the requirements of USCG 46, CFR 39 or the IMO Standards for Vapour Emission Control Systems (MSC Circular 585). A certificate or statement of compliance issued by LR or a competent authority recognised by LR is to be provided. As an alternative, a self-contained vapour recovery system, which is of a type approved by LR and which achieves equivalent performance to the systems above, may be fitted.

~~*3.9.3*~~ *3.16.3* For assignment of the **Vp** character, a self-contained system capable of preventing vapour emission formation during loading is to be fitted. This vapour emission prevention system is to be of a type approved by LR and is to reduce vapour emission formation by at least 75 per cent (v/v) as compared to an equivalent ship to which no vapour emissions prevention system has been fitted.

■ *Section 4* Survey requirements

4.2 Periodical Surveys and Audits

4.2.4 Where the periodical surveys and audits are not completed in accordance with 4.2.1, the **EP** Notation will be suspended. Re-instatement will be subject to surveys being held, as directed by the Committee, appropriate to the age of the ship and the circumstances of the case.

Part 8, Chapter 1
Application

Effective date 1 January 2010

■ *Section 2*
Ice environment

2.4 Ice Class notations

2.4.2 In general, an **Ice Class** Notation contained in this Part of the Rules will only be assigned where the vessel has been assigned a [✠]LMC notation. A [✠]LMC notation may be accepted where ice class machinery items are not included within the scope of the propulsion arrangements for acceptance of a manufacturer's certificate, *see* Pt 1, Ch 1.

Part 8, Chapter 2
Ice Operations – Ice Class

Effective date 1 January 2010

■ *Section 2*
General hull requirements for navigation in ice – All Ice Classes

2.1 General

2.1.1 ~~In addition to the requirements of the *Finnish-Swedish Ice Class Rules*, the~~ The following Sections are to be complied with for ~~**Ice Class 1AS FS**, **Ice Class 1A FS**, **Ice Class 1B FS**, **Ice Class 1C FS** and **Ice Class 1D**~~ all Ice Classes, where applicable. Alternative arrangements to attain similar performance will be specially considered.

■ *Section 3*
General machinery requirements for navigation in ice – All Ice Classes

3.1 Materials for shafting

3.1.1 The following Sections are to be complied with for all Ice Classes, where applicable. Alternative arrangements to attain similar performance will be considered.

~~*3.1.1*~~ *3.1.2* All components of the main propulsion system are to be of steel or other approved ductile material.

~~*3.1.2* For screwshafts in ships intended for the notation **Ice Class 1AS FS** or **Ice Class 1A FS** and where the connection between the propeller and the screwshaft is by means of a key, Charpy impact tests are to be made in accordance with the requirements of Ch 5,3.4.12 of the *Rules for the Manufacture, Testing and Certification of Materials* (hereinafter referred to as the Rules for Materials).~~

3.2 Materials for propellers

3.2.2 For steel propellers, the elongation of the material used is to be not less than ~~19~~ 15 per cent for a test piece length of 5*d*. Charpy impact tests are to be carried out in accordance with the requirements of the Rules for Materials.

■ *Section 6*
Hull requirements for first-year ice conditions – Ice Classes 1AS FS, 1A FS, 1B FS, 1C FS and 1D

6.1 General

6.1.1 In addition to the requirements of the *Finnish-Swedish Ice Class Rules*, the following Sections are to be complied with for **Ice Class 1AS FS**, **Ice Class 1A FS**, **Ice Class 1B FS**, **Ice Class 1C FS** and **Ice Class 1D**, where applicable. Alternative arrangements to attain similar performance will be considered.

Existing sub-Sections 6.1 *to* 6.5 *are to be renumbered* 6.2 *to* 6.6.

Section 7
Machinery requirements for first-year ice conditions – Ice Classes 1AS FS, 1A FS, 1B FS and 1C FS

7.1 General

7.1.1 ~~Where the notation **Ice Class 1AS FS**, **Ice Class 1A FS**, **Ice Class 1B FS** or **Ice Class 1C FS** is desired, the requirements of this Section, in addition to those for open water service, are to be complied with, so far as these are applicable.~~ In addition to the requirements of the *Finnish-Swedish Ice Class Rules*, the following Sections are to be complied with for **Ice Class 1AS FS**, **Ice Class 1A FS**, **Ice Class 1B FS** and **Ice Class 1C FS**, where applicable. Alternative arrangements to attain similar performance will be specially considered.

7.2 Determination of ice torque

~~*7.2.1* Dimensions of propellers, shafting and gearing are determined by formulae taking into account the impact when a propeller blade hits ice. The ensuing load is hereinafter defined by ice torque, *M*.~~

~~$M = m D^2$ kN m~~

~~where~~

~~m = 21,10 for **Ice Class 1AS FS**~~
~~= 15,69 for **Ice Class 1A FS**~~
~~= 13,04 for **Ice Class 1B FS**~~
~~= 11,96 for **Ice Class 1C FS**~~
~~D = diameter of propeller, in metres~~

~~*7.2.2*~~ *7.2.1* If the propeller is not fully submerged when the ship is in ballast condition, the ~~ice torque~~ requirements for **Ice Class 1A FS** is to be used for **Ice Class 1B FS** and **Ice Class 1C FS**.

7.3 Propeller blade sections

~~*7.3.1* The width, *L*, and thickness, *T*, of propeller blade sections are to be determined so that:~~

~~(a) at the radius 0,25*D*/2, for solid propellers~~

$$\frac{LT^2}{} \geq \frac{26\,478\,000}{\sigma_u (0{,}65 + 0{,}7 p_r/D)} \left(27{,}2 \frac{P}{NR} + 2{,}24M \right)$$

~~(b) at radius 0,35*D*/2 for controllable pitch propellers~~

$$\frac{LT^2}{} \geq \frac{21\,084\,300}{\sigma_u (0{,}65 + 0{,}7 p_r/D)} \left(27{,}2 \frac{P}{NR} + 2{,}35M \right)$$

~~(c) at the radius 0,6*D*/2~~

$$\frac{LT^2}{} \geq \frac{9\,316\,320}{\sigma_u (0{,}65 + 0{,}7 p_r/D)} \left(27{,}2 \frac{P}{NR} + 2{,}86M \right)$$

~~where~~

~~D = diameter of propeller, in metres~~
~~L = length of the expanded cylindrical section of the blade, at the radius in question, in mm~~
~~M = ice torque as defined in 7.2~~
~~N = number of blades~~
~~p_r = propeller pitch at the radius in question, for solid propellers, in metres~~
~~= 0,7 nominal pitch for controllable pitch propellers, in metres~~
~~P = shaft power as defined in Pt 5, Ch 1,3.3~~
~~R = propeller speed, in rev/min~~
~~T = the corresponding maximum blade thickness, in mm~~
~~σ_u = specified minimum tensile strength of the material, in N/mm^2.~~

~~*7.3.2*~~ *7.3.1* Where the blade thickness derived from ~~these formulae~~ the *Finnish-Swedish Ice Class Rules* is less than the blade thickness derived by Pt 5, Ch 7,3.1, the latter is to apply.

~~7.4~~ ~~Propeller blade minimum tip thickness~~

~~*7.4.1* The blade tip thickness, *t*, at the radius *D*/2 is to be determined by the following formulae:~~

~~**Ice Class 1AS FS**~~

$$t = \frac{(20 + 2D)}{} \sqrt{\frac{490}{\sigma_u}} \text{ mm}$$

~~**Ice Classes 1A FS**, **1B FS** and **1C FS**~~

$$t = \frac{(15 + 2D)}{} \sqrt{\frac{490}{\sigma_u}} \text{ mm}$$

~~where~~

~~D and σ_u = are as defined in 7.3.~~

Existing sub-Sections 7.5 to 7.10 *are to be renumbered* 7.4 *to* 7.9.

~~7.5~~ 7.4 Intermediate blade sections

~~*7.5.1*~~ *7.4.1* The thickness of other sections is to conform to a smooth curve connecting the section thicknesses as determined by ~~7.3 and 7.4~~ the *Finnish-Swedish Ice Class Rules*.

~~7.9~~ 7.8 Screwshafts

~~*7.9.1* The diameter d_s at the aft bearing of the screwshaft fitted in conjunction with a solid propeller is to be not less than:~~

$$d_s = \frac{1{,}08}{} \sqrt[3]{\frac{\sigma_u LT^2}{\sigma_e}} \text{ mm}$$

~~where~~

~~L and T = proposed width and thickness respectively of the propeller blade section at 0,25*D*/2, in mm~~
~~σ_e = specified minimum yield stress of the material of the screwshaft, in N/mm^2~~
~~σ_u = specified minimum tensile strength of the blade material, in N/mm^2~~

~~*7.9.2* The diameter, d_s at the aft bearing of the screwshaft fitted in conjunction with a controllable pitch propeller is to be not less than:~~

$$d_s = \frac{1{,}15}{} \sqrt[3]{\frac{\sigma_u LT^2}{\sigma_e}} \text{ mm}$$

~~where~~

~~L and T = proposed width and thickness respectively of the propeller blade section at 0,35D/2, in mm~~

~~σ_e = specified minimum yield stress of the material of the screwshaft, in N/mm^2~~

~~σ_u = specified minimum tensile strength of the blade material, in N/mm^2.~~

~~7.9.3~~ *7.8.1* Where the screwshaft diameter as derived by ~~7.9.1 or 7.9.2~~ the *Finnish-Swedish Ice Class Rules* is less than the diameter derived by Pt 5 Ch 6,3.5.1, the latter is to apply.

~~7.9.4~~ *7.8.2* The diameter, d_s, of the screwshaft determined in accordance with ~~this Section~~ the *Finnish-Swedish Ice Class Rules* is to extend over a length not less than that to the forward edge of the bearing immediately forward of the propeller or 2,5d_s whichever is the greater.

~~7.9.5~~ *7.8.3* The shaft may be tapered at the forward end in accordance with Pt 5, Ch 6,3.5.3 and Pt 5, Ch 6,3.5.4, except for **Ice Class 1AS FS** ice strengthening, where these diameters are to be increased by 10 per cent.

7.8.4 For screwshafts in ships intended for the notation **Ice Class 1AS FS** or **Ice Class 1A FS** and where the connection between the propeller and the screwshaft is by means of a key, Charpy impact tests are to be made in accordance with the requirements of Ch 5,3.4.12 of the Rules for Materials.

~~7.11 Reduction gearing~~

~~7.11.1 Where gearing is fitted between the engine and the propeller shafting, the gearing is to be in accordance with Pt 5, Ch 5, and is to be designed to transmit a torque, Y_t, taken as the greater of the following conditions:~~

~~(a) Ice load conditions (ice torque applied to mean torque)~~

$$Y_t = Y + \frac{M I_h u^2}{I_t + I_h u^2} \text{ kN m}$$

~~where~~

~~u = gear ratio~~

~~= pinion speed / wheel speed~~

~~I_h = mass moment of inertia of machinery components rotating at higher speed~~

~~I_t = mass moment of inertia of machinery components rotating at lower speed, including propeller with an addition of 30 per cent of entrained water (I_h and I_t are to be expressed in the same units)~~

~~M = ice torque as defined in 7.2~~

~~Y = 9,55 P/R~~

~~P and R = are as defined in 7.3~~

~~(b) Open water conditions (K_A factor applied to mean torque)~~

~~Y_t = $Y K_A$ KN m~~

~~Y = as above~~

~~K_A = application factor as given in Table 5.3.1 in Pt 5, Ch 5.~~

■ *Section 9*
Machinery requirements for first-year ice conditions – Ice Classes 1AS FS(+), 1A FS(+), 1B FS(+) and 1C FS(+)

9.2 Materials for shafting

9.2.1 For screwshafts in ships intended for the notation **Ice Class 1AS FS(+)** or **Ice Class 1A FS(+)** and where the connection between the propeller and the screwshaft is by means of a key, Charpy impact tests are to be made in accordance with the requirements of Ch 5,3.4.12 of the Rules for Materials.

■ *Section 10*
Hull strengthening requirements for navigation in multi-year ice conditions – Ice Classes PC1, PC2, PC3, PC4, PC5, PC6 and PC7

10.4 Bow area

(*Part only shown*)

10.4.3 The bow area load characteristics are determined as follows:

(b) Force, F_i:

$$F_i = fa_i \, C_C \, ~~D^{0,64}~~ \Delta^{0,64} \text{ MN}$$

where

i = sub-region considered

fa_i = shape coefficient of sub-region, i

C_C = crushing failure class factor from Table 2.10.1

Δ = ship displacement, in kilo tonnes, not to be taken less than 5

10.10 Framing – General

(*Part only shown*)

10.10.7 The actual net effective shear area, A_w, of a framing member is given by:

~~$A_w = h\, t_{wn} \sin\left(\frac{\Phi_w}{100}\right)$~~ $A_w = \frac{h\, t_{wn} \sin\varphi_w}{100}$ cm^2

10.11 Framing – Transversely-framed side structures and bottom structures

(*Part only shown*)

10.11.3 The actual net effective plastic section modulus of the plate/stiffener combination, Z_p, as defined in 10.10.8 or 10.10.9, is to comply with the following conditions and is to be the greatest of the two load conditions:

(b) the ice load acting near a support.

$$Z_p \geq Z_{pt}$$

where

$$Z_{pt} = \frac{~~100^3 I_L Y s AF K_t P_a a A_1~~}{~~4\sigma_y~~}$$

$$\frac{100^3 I_L Y s AF K_t P_a a A_1}{4\sigma_y} \text{ cm}^3$$

$$Y = \frac{l_L}{2a} \quad 1 - \frac{l_L}{2a}$$

Section 11
Machinery strengthening requirements for navigation in multi-year ice conditions – Ice Classes PC1, PC2, PC3, PC4, PC5, PC6 and PC7

11.1 Application

11.1.2 For **PC6** and **PC7**, the requirements will be considered with respect to compliance with the *Finnish-Swedish Ice Class Rules*.

11.9 Design ice loads for open propeller

11.9.3 The maximum forward blade force, F_f, is to be taken as:
when $D < D_{limit}$

$$F_f = 250 \left(\frac{EAR}{Z}\right) D^2 \quad \text{kN}$$

when $D \geq D_{limit}$

$$F_f = 500 \left(\frac{1}{1 - \frac{d}{D}}\right) H_{ice} \left(\frac{EAR}{Z}\right) D \quad \text{kN}$$

where

$$D_{limit} = \left(\frac{2}{1 - \frac{d}{D}}\right) H_{ice} \text{ m}$$

d = propeller hub diameter, in metres
D = propeller diameter, in metres
EAR = expanded blade area ratio
Z = number of propeller blades.

11.10 Design ice loads for ducted propellers

(Part only shown)
11.10.3 The maximum forward blade force, F_f, is to be taken as:
when $D \leq D_{limit}$

$$F_f = 250 \left(\frac{EAR}{Z}\right) D^2 \quad \text{kN}$$

when $D > D_{limit}$

$$F_f = 500 \left(\frac{EAR}{Z}\right) D \left(\frac{1}{1 - \frac{d}{D}}\right) H_{ice} \quad \text{kN}$$

where

$$D_{limit} = \left(\frac{2}{1 - \frac{d}{D}}\right) H_{ice} \text{ m}$$

Cross-References

Section numbering in brackets reflects any Section renumbering necessitated by any of the Notices that update the current version of the Rules for Ships.

Part 1, Chapter 3

2.2.31(u) *Reference* Tables 3.8.4, 3.8.5, 3.8.6 and 3.8.7 *now reads* Tables 3.8.5, 3.8.6, 3.8.7 and 3.8.8.

Part 5, Chapter 13

12.5.5 *Reference* Pt 4, Ch 2,10 *now reads* Pt 4, Ch 2,11.

Part 6, Chapter 2

18.3.15 *Reference* Pt 4, Ch 2,10.2 *now reads* Pt 4, Ch 2,11.2.8.

Part 8, Chapter 2

6.3.3 *Reference* 6.5.2 *now reads* 6.6.2.
(6.4.3)
6.3.5 *Reference* 6.3.2 *now reads* 6.4.2.
(6.4.5)
6.5.4 *Reference* 6.5.1 *now reads* 6.6.1.
(6.6.4)

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